



**2011**  
HSC HALF YEARLY  
EXAMINATION PAPER

# General Mathematics

## General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black or blue pen or pencil
- Board approved calculators may be used
- A formulae sheet is provided at the back of this paper

## Total Marks – 100

### Section I

Pages 2 - 9

### 22 marks

- Attempt Questions 1-22
- Allow about 30 minutes for this section

### Section II

Pages 10 - 24

### 78 marks

- Attempt Questions 23 - 28
- Allow about 2 hours for this section

## Section I

**22 marks**

**Attempt Questions 1 – 22**

**Allow about 30 minutes for this section**

Use the multiple-choice answer sheet for Questions 1 – 22.

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- 1** The value of  $\frac{15.3-7.8}{\sqrt{1.9^2+3}}$  correct to three significant figures is:
- (A) 2.91
  - (B) 2.92
  - (C) 12.3
  - (D) 16.1
- 2** The total repayments for a \$3400 loan on a flat rate interest of 8.5% p.a. over a 3 year period are:
- (A) \$4342.78
  - (B) \$4267
  - (C) \$942.78
  - (D) \$867
- 3** A coin is tossed three times. What is the probability that on the third toss it is a head?
- (A)  $\frac{1}{8}$
  - (B)  $\frac{1}{4}$
  - (C)  $\frac{1}{3}$
  - (D)  $\frac{1}{2}$

**4**  $m - n$  subtracted from  $2m + n$  gives:

- (A)  $m$
- (B)  $-m$
- (C)  $m + 2n$
- (D)  $-m - 2n$

**5** Craig covered the 400 metres of the drag racing strip in 10 seconds. What was his average speed in km/h?

- (A) 90
- (B) 120
- (C) 144
- (D) 240

**6** Which of the following tables gives an example of declining balance depreciation?

(A)

Year	Salvage Value (\$)
New (0)	40000
1	32000
2	25600
3	20480
4	16384

(C)

Year	Salvage Value (\$)
New (0)	8500
1	7846
2	7192
3	6538
4	5884

(B)

Year	Salvage Value (\$)
New (0)	20000
1	19800
2	19600
3	19400
4	19200

(D)

Year	Salvage Value (\$)
New (0)	40000
1	32000
2	24000
3	16000
4	8000

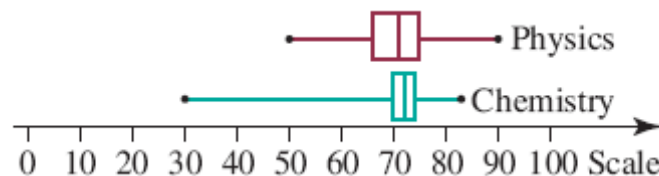
- 7** Over Easter, Dylan worked 16 hours at the normal hourly rate of pay and 16 hours at double time-and-a-half. He earned \$461.44 in total for this work.

What was the normal hourly rate of pay?

- (A) \$7.21
- (B) \$8.24
- (C) \$11.54
- (D) \$14.42

- 8** The box-and whisker plot shows Sven's performance in his Physics and Chemistry examinations.

Which of the following statements is correct?



- (A) The Range of Sven's marks in Physics is greater than for Chemistry
  - (B) The median of Sven's mark in Chemistry is greater than for Physics
  - (C) The interquartile range of Sven's marks in Physics is greater than for Chemistry
  - (D) More than one of the above statements are correct
- 9** After nine games of netball the goal shooter has an average of 14 goals. In the next game she scores 24 goals. What is her new average?
- (A) 14
  - (B) 15
  - (C) 16
  - (D) 19

**10** The radius of the Earth is approximately 6400 km. The circumference of the Earth at the Equator is closest to:

- (A)  $1.28 \times 10^8$  km
- (B)  $1.29 \times 10^8$  km
- (C) 20106 km
- (D) 40212 km

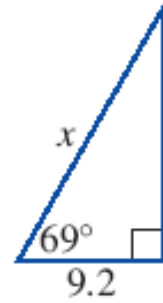
**11** The interest earned on \$10000 invested at 8% p.a. for 10 years, with interest compounded annually is:

- (A) \$11589.25
- (B) \$21589.25
- (C) \$134865.62
- (D) \$144865.62

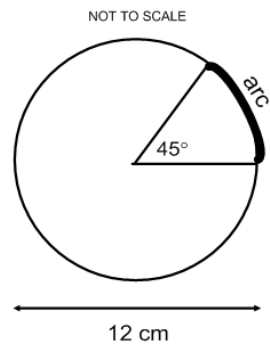
**12** Which of the following is *not* an example of a linear function?

- (A)  $y = 3x^2$
- (B)  $y = 2x - 3$
- (C)  $2y = x + 1$
- (D)  $x + 2y + 3 = 0$

- 13** Consider the diagram and state which of the following is true:



- (A)  $x = 9.2 \sin 69^\circ$
- (B)  $x = \frac{9.2}{\sin 69^\circ}$
- (C)  $x = 9.2 \cos 69^\circ$
- (D)  $x = \frac{9.2}{\cos 69^\circ}$
- 14** The length of the arc is closest to:



- (A) 4.7 cm
- (B) 9.4 cm
- (C) 14.1 cm
- (D) 37.7 cm

- 15** Phillip invests \$2000 per year into an annuity for a period of 20 years. The interest rate is 6.5% p.a. and interest is compounded annually.

The present value of the annuity is:

- (A) \$7047.30
- (B) \$22037.02
- (C) \$37650.62
- (D) \$77650.62

- 16**  $3x(2x - 4y) - 2y(4y - 6x) =$

- (A)  $6x^2 - 8y^2$
- (B)  $6x^2 + 8y^2$
- (C)  $6x^2 - 24xy - 8y^2$
- (D)  $6x^2 - 24xy + 8y^2$

- 17** A loan can be taken out at 9% p.a. flat interest or 10% p.a. reducible interest.

Using the formula  $E = \frac{(1+r)^n - 1}{n}$ ,

the number of years of the loan (n) after which the effective rate of interest on the flat rate loan becomes greater than the reducible rate loan is:

- (A) 2 years
- (B) 3 years
- (C) 4 years
- (D) 5 years

- 18** The solution to the equation  $10^x = 200$  is closest to:

- (A) 2
- (B) 2.3
- (C) 2.4
- (D) 20

- 19** The data below show the number of people that live in each house in a small street.

4, 4, 5, 3, 2, 5, 11, 2

The outlier in this data set has:

- (A) The greatest effect on the mean
  - (B) The greatest effect on the median
  - (C) The greatest effect on the mode
  - (D) An equal effect on the mean, median and mode
- 20** The table shows monthly repayments for loans over 30 years.

		<i>Loan amount (thousands of dollars)</i>				
		<b>\$200</b>	<b>\$250</b>	<b>\$300</b>	<b>\$350</b>	<b>\$400</b>
<i>Interest rate per annum</i>	5.0 %	\$1074	\$1343	\$1612	\$1881	\$2149
	5.5 %	\$1136	\$1420	\$1704	\$1988	\$2272
	6.0 %	\$1200	\$1500	\$1800	\$2100	\$2399
	6.5 %	\$1266	\$1583	\$1899	\$2217	\$2532
	7.0 %	\$1332	\$1665	\$1998	\$2331	\$2665
	7.5 %	\$1399	\$1749	\$2099	\$2449	\$2798

Beth borrows \$350 000 over a period of 30 years at 6.5% per annum. Repayments are to be made monthly according to the table.

How much would Beth repay over 30 years if the interest rate were to remain the same?

- (A) \$2217
- (B) \$66 510
- (C) \$682 500
- (D) \$798 120



- 21** Consider the data displayed on the stem and leaf plot which shows the number of gold medals won by the country Wattersia at each of the last 15 Olympic games

Stem | Leaf    Key 1 | 5 = 15

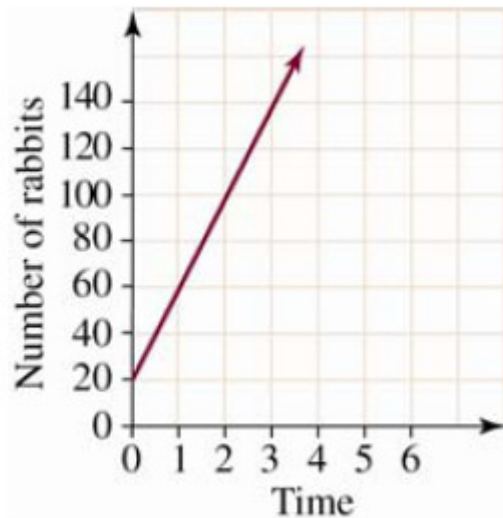
0 | 0 1 3 5 5 8

1 | 0 0 2 3 7 7 8

2 | 0 1

The range of the data is:

- (A) 12  
(B) 13  
(C) 20  
(D) 21
- 22** The graph shows the number of rabbits on Smith's rabbit breeding farm



The gradient of the line is:

- (A) 2  
(B) 10  
(C) 20  
(D) 40

## Section II

**78 marks**

**Attempt Questions 23 – 28**

**Allow about 2 hours for this section**

Begin each question on a new page.

All necessary working should be shown in every question.

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**Question 23** (13 marks) Start a new page for your answers.

- (a) Different vegetables are to be served for dinners at a school camp. A sample of children was asked which vegetable they preferred. The results were as follows:

Vegetable	frequency
Peas	4
Beans	3
Carrot	6
Cauliflower	2
Zucchini	5
	20

- (i) What is the relative frequency of the most popular vegetable? **1**
- (ii) What percentage of children surveyed preferred peas? **1**
- (iii) On a sector graph what angle would be used to represent beans? **1**
- (iv) This survey is best described as: (choose one) **1**
- ⊕ Stratified sample
  - ⊕ Random sample
  - ⊕ Census
  - ⊕ Discrete sample

**Question 23 continues on next page**

Question 23 (continued)

- (b) If number plates consist of 3 letters and 3 digits, how many different plates are possible if the first letter must be A, B or C, and the first digit cannot be 0 or 1? **2**
- (c) Draw your own example of a prism on the square grid paper provided at the back of your paper **1**
- (d) Below is Gerard's credit card statement for June. The interest rate charged on the credit card is 21.5% p.a. with interest calculated on a daily rate.

	Daily interest rate = 0.000589	
<i>Date</i>	<i>Transaction</i>	<i>Balance</i>
1 <sup>st</sup> June	Opening balance	\$2500.00
4 <sup>th</sup> June	Purchase - \$560.00	\$3060.00
15 <sup>th</sup> June	Payment - \$700.00 – thank you	\$2360.00
22 <sup>nd</sup> June	Purchase \$145.50	\$2505.50
1 <sup>st</sup> July	Interest _____	_____

- (i) Justify why the daily interest rate is as printed on the statement **1**
- (ii) Calculate the interest and closing balance for Gerard's credit card statement. **2**

**Question 23 continues on next page**

Question 23 (continued)

- (e) Kevin wants to invest \$5 000 for 3 years and has the following choices:

	<i>Investment for 3 years</i>
<i>Save With Us</i>	6.5% p.a. with interest paid each year.
<i>Savings Bank</i>	6% p.a. compounded monthly. <i>Interest paid at the end of the investment period.</i>

- (i) Calculate the total interest paid by *Save With Us*. **1**
- (ii) Use the compound interest formula to calculate the total amount returned to the investor under the *Savings Bank* option. **2**

**End of Question 23**

**Question 24** (13 marks) Start a new page for your answers.

- (a) An ocean liner travels at an average speed of 18 knots from (45°S, 160°E) to (21°S, 160°E).  
(i) How many nautical miles (M) did the liner travel? **1**  
(ii) How long did the journey take? Answer correct to the nearest hour. **1**
- (b) Evaluate  $6w^3 - x^2 + y$ , given  $w = 2$ ,  $x = 3$  and  $y = -1$  **2**
- (c) Romeo is located at (42°N, 15°E) and Sydney is located at (34°S, 150°E)  
(i) What is the difference in longitude between Romeo and Sydney? **1**  
(ii) When it is 12 noon Greenwich Mean Time, what time (ignoring time zones) should it be in Romeo? **1**  
(iii) Anthony is on holidays in Romeo and phones his friend in Sydney. If he calls at 9 p.m. on Friday, what is the day and time in Sydney? **2**

**Question 24 continues on next page**

Question 24 (continued)

(d) Dashan is paid a salary of \$77 948 and earns \$354 in bank interest. His allowable deductions amount to \$862.

(i) Calculate Dashan's taxable income. **1**

(ii) Use this tax table to calculate Dashan's tax payable. **2**

Tax rates 2010–11

<i>Taxable income</i>	<i>Tax on this income</i>
0 – \$6,000	Nil
\$6,001 – \$37,000	15c for each \$1 over \$6,000
\$37,001 – \$80,000	\$4,650 plus 30c for each \$1 over \$37,000
\$80,001 – \$180,000	\$17,550 plus 37c for each \$1 over \$80,000
\$180,001 and over	\$54,550 plus 45c for each \$1 over \$180,000

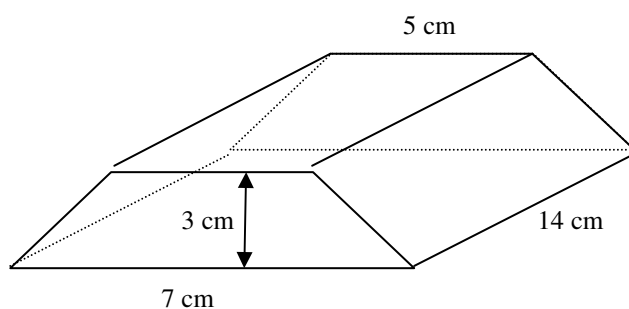
(iii) As part of his taxation obligation, Dashan must also pay a Medicare levy of 1.5% of his taxable income. Calculate the amount of Dashan's Medicare levy using your answer from part (i) above. **1**

(iv) If Dashan has paid \$22000 in PAYE tax installments throughout the year, does he receive a refund or a tax bill? (justify your answer) **1**

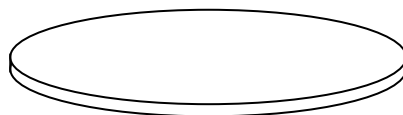
**End of Question 24**

**Question 25** (13 marks) Start a new page for your answers.

- (a) To make the gold medals for the next International Games a goldsmith is given 10 gold ingots, each in the shape of a trapezoidal prism, with dimensions as shown.



- |       |   |          |
|-------|---|----------|
| (i)   | What is the total volume of the 10 gold ingots in cubic centimetres ( $\text{cm}^3$ )?                          | <b>3</b> |
| (ii)  | The goldsmith melts the ingots and uses all the gold to make 210 gold medals. What is the volume of each medal? | <b>1</b> |
| (iii) | Each gold medal is cylindrical and 0.4 cm thick.  | <b>2</b> |

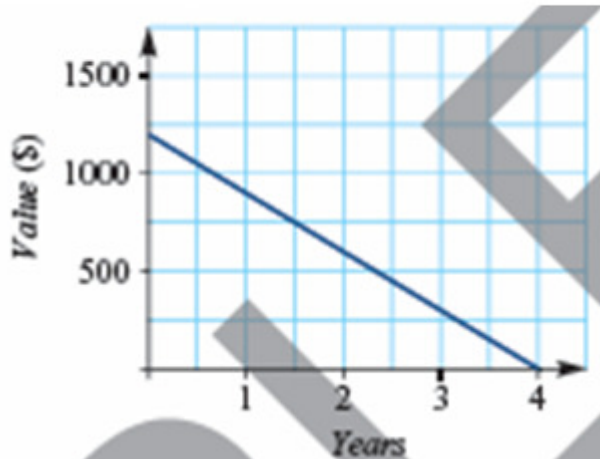


Calculate the radius of each medal to the nearest mm.

**Question 25 continues on next page**

Question 25 (continued)

- (b) The graph shows the depreciation of a printer over four years



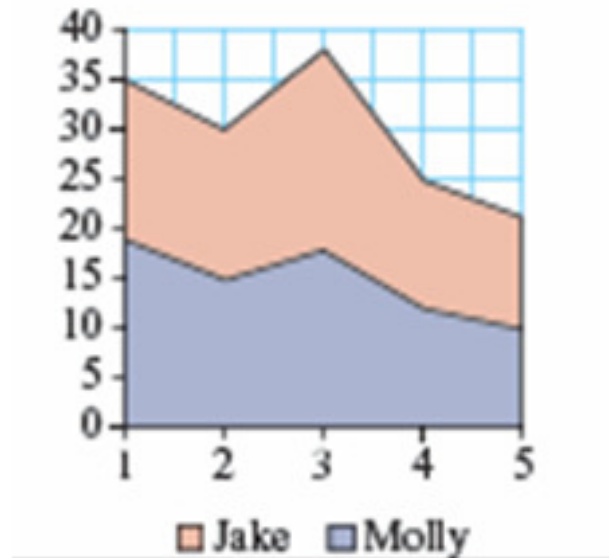
- (i) What was the initial value? **1**
- (ii) How much did the printer depreciate each year? **1**
- (iii) Write a function describing the salvage value of the printer **1**
- (c) (i) Rearrange the formula  $V = \frac{1}{3}\pi r^2 h$  to make  $r$  the subject **2**
- (ii) Calculate the value of  $r$ , when  $V = 3000$  and  $h = 15$  **2**

**End of Question 25**



**Question 26** (13 marks) Start a new page for your answers.

- (a) The area chart shows the results of five tasks for Jake and Molly. (Jake is the lighter shading)

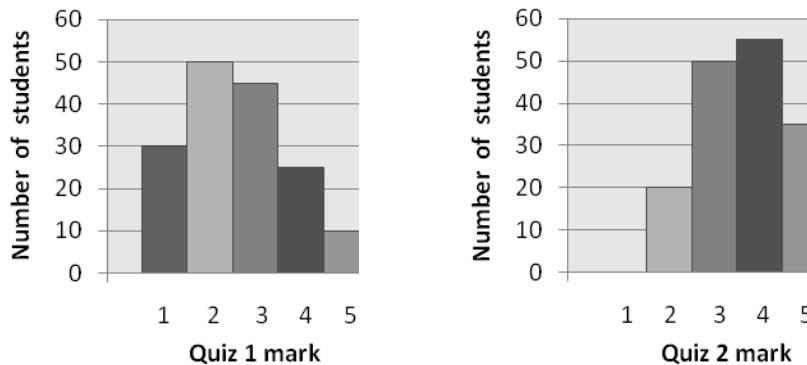


- |                                |  |          |
|--------------------------------|--|----------|
| (i)                            | What was Jake's result for the first task?               | <b>1</b> |
| (ii)                           | Which task had the least total score for Jake and Molly? | <b>1</b> |
| <br>(b) Simplify the following |  |          |
| (i)                            | $4g^2 \times 6g^2$                                       | <b>1</b> |
| (ii)                           | $\frac{30x^4y}{5y}$                                      | <b>1</b> |
| (iii)                          | $(2c^2d^3)^4$  | <b>1</b> |

**Question 26 continues on next page**

Question 26 (continued)

(b) The following graphs show the quiz results for 160 students.



(i) Calculate the mean and standard deviation, correct to 2 decimal places, for Quiz 1. **2**

(ii) Complete the table that is provided for you **at the back of the paper** **1**

	Quiz 1	Quiz 2
Quartile 1	2	
Median	2.5	
Quartile 3	3	

Do not write in this one, this is only what it looks like, write your answer on the one of these at the back of your paper

(iii) On the number line provided, construct a double box-and-whisker plot for the quiz results. **4**

Quiz 1 was taken before the topic was revised and Quiz 2 was given after the revision lesson.

With reference to skewness, write a brief statement that compares the distribution of the marks from the first quiz with those from the second quiz. **1**

**End of Question 26**

**Question 27** (13 marks) Start a new page for your answers.

- (a) David wants to buy a work vehicle at the end of his TAFE course. He plans to deposit \$250 into an account at the end of each month for the 2 years of his studies. The account earns 4.8% p.a. interest, compounding monthly.

David's father agreed to match David's savings dollar-for-dollar. He used the present value of an annuity formula to calculate the single amount he needed to invest so he could achieve the same financial result as David's savings plan.

- (i) Explain why 0.004 is used to calculate the monthly interest. **1**
- (ii) Write down the formula with the correct substitutions for David's **father's** investment. **1**
- (iii) Find the amount David's **father** invested. **1**
- (iv) Calculate the future value of **David's investment**. **2**
- (b) At the conclusion of his studies, David decided to purchase a more expensive vehicle and borrowed \$16 000 to cover the additional costs. The interest rate of 7.8% per annum compounded fortnightly, and the repayments were set at \$265.

The loan balance sheet shows the interest charged and the balance owing after the first fortnight.

<i>Period</i>	<i>Principal at the start of the period</i>	<i>Period interest</i>	<i>Fortnightly repayment</i>	<i>Balance at end of period</i>
1	\$16 000	$16\,000 \times 0.003 = \$48$	\$265	\$15 783
2	\$15 783	I	\$265	II

**2**

Find the missing amounts I and II.

**Question 27 continues on next page**

Question 27 (continued)

- (c) David wanted to calculate the number of fortnightly repayments,  $n$ , it would take to repay the loan fully. He used the 'guess-and-check' method to estimate  $n$  in the following equation.

$$\$265 \times \left\{ \frac{(1.003)^n - 1}{0.003 \times (1.003)^n} \right\} = \$16\,000$$

Here is his working.

Try  $n = 50$ :

$$\$265 \times \left\{ \frac{(1.003)^{50} - 1}{0.003 \times (1.003)^{50}} \right\} \approx \$12\,287$$

Hence  $n = 50$  is too small.

- (i) David's next guess is  $n = 70$ . Show David's working for this guess, including the calculation and conclusion. **2**
- (ii) State a reasonable value of  $n$  for the next guess. **1**
- (d) David can claim the depreciation on his work vehicle as a taxation deduction.

The vehicle cost \$29 000 and depreciates in value by \$4 000 per year for the first three years.

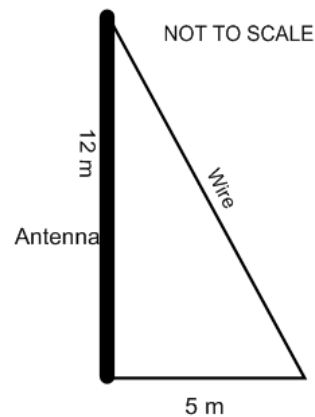
After the end of the third year, David changes to the declining balance method of depreciation as the rate is 25% per annum.

- (i) Calculate the value of the vehicle at the end of the third year. **1**
- (ii) Calculate the value of the vehicle six years after it was purchased. **2**

**End of Question 27**

**Question 28** (13 marks) Start a new page for your answers.

- (a) A television antenna is 12 m high. To support it a wire is attached to the ground 5 m from the foot of the antenna. Find the length of the wire.



- (b) Convert 0.000000376 cm to km (express your answer in scientific notation)

**2  
1**

- (c) George has a stand selling ice blocks at the beach. George finds that the number of ice creams that he sells each day can be estimated using the formula

$$N = 1000 - 2P,$$

where  $N$  represents the number of ice blocks that he sells, and  $P$  is the price of the ice blocks **in cents**.

- (i) What will be the number of ice blocks that George will sell if he sells them for \$1.50 each?

**1**

- (ii) Copy and complete the table below

$P$	100	150	200	250	300
$N$					

**2**

- (iii) Use the grid paper provided to plot the graph of :

$$N = 1000 - 2P$$

**2**

- (iv) Leo sets up another ice block stand at the beach and wants to sell ice blocks for \$6.00 each. Explain why the formula  $N = 1000 - 2P$  does not give a reasonable estimate of the number of ice blocks that Leo will sell.

**1**

- (d) Using the formula  $d = 5t^3 - 2$ ,  
 Marcia tried to find the value of  $t$  when  $d = 137$ .  
 Here is her solution. She has made one mistake.

$d = 5t^3 - 2$ $137 = 5t^3 - 2$ $135 = 5t^3$ $27 = t^3$ $t = 3$	..... Line A ..... Line B ..... Line C ..... Line D
---	--

Which line does NOT follow correctly from the previous line? (answer by writing on your paper either A, B, C or D)

- (A) Line A  
 (B) Line B  
 (C) Line C  
 (D) Line D

**1**

- (e) A tree's height is 17.3m, correct to one decimal place.  
 What is the maximum error in the measurement of the height of the tree?

**1**

- (f) The diagram below shows a stem and leaf plot for 22 scores

2		3	5	9		
3		1	4	7	9	
4		2	4	4	5	7
5		1	2	4		
6		2	3	7		
7		5	8	8	8	

What is the median and mode for the distribution?

**2**

**End of paper**

Student Name .....

Class .....

**HSC GENERAL MATHEMATICS HALFYEARLY EXAMINATION  
2011  
MULTIPLE CHOICE ANSWER SHEET**

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample:  $2+4 =$  (A) 2 (B) 6 (C) 8 (D) 9  
A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ☒ B ☒ C ☐ D ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word *correct* and drawing an arrow as follows.

A ☒ B ☒ C ☐ D ☐  
correct

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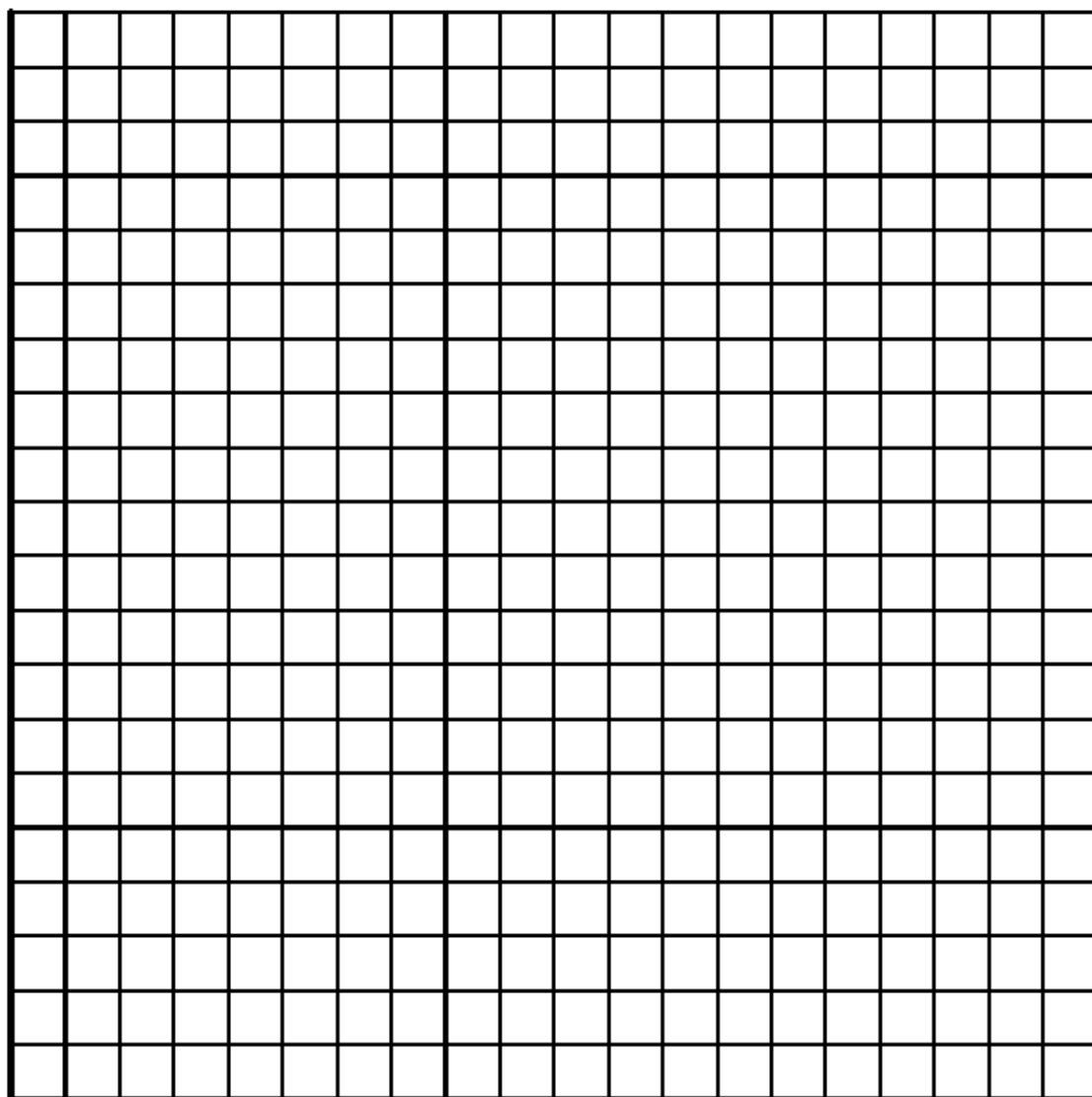
**ATTEMPT ALL QUESTIONS**

- |    |                         |                         |                         |                         |    |                         |                         |                         |                         |
|----|-------------------------|-------------------------|-------------------------|-------------------------|----|-------------------------|-------------------------|-------------------------|-------------------------|
| 1  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 12 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 2  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 13 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 3  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 14 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 4  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 15 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 5  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 16 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 6  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 17 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 7  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 18 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 8  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 19 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 9  | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 20 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 10 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 21 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |
| 11 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D | 22 | <input type="radio"/> A | <input type="radio"/> B | <input type="radio"/> C | <input type="radio"/> D |

Student Name .....

Class .....

Graph paper for Question 28 (c) (iii)





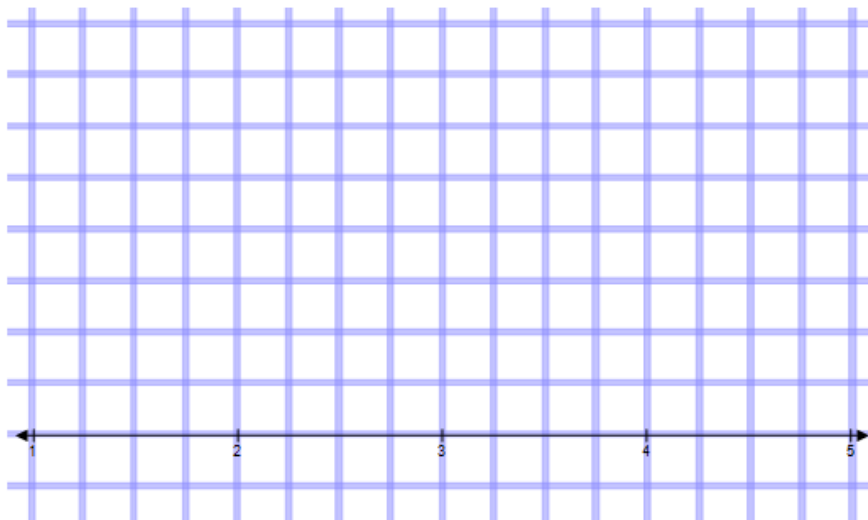
Student Name .....

Class .....

Table for Question 26 (b) (ii)

	Quiz 1	Quiz 2
Quartile 1	2	
Median	2.5	
Quartile 3	3	

Box and whisker plot for Question 26 (b) (iii)



Grid paper for Question 23 (c)

